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THE
RESULT
OF
A VIEW and SURVEY
OF
YARMOUTH HAVEN,

Taken in the YEAR 1747.

By CHARLES LABELYE, ENGINEER.



*Virtus est, Vitium fugere, et Sapientia Prima
Stultitia caruisse; —————*

HOR. EPIST. I. *Lib.* I:

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A VIEW and SURVEY, &c.

*To the Right Worshipful the MAYOR, ALDER-
MEN, and COMMON-COUNCIL of the Cor-
poration of YARMOUTH, in the County
of Norfolk.*

GENTLEMEN,

I Have taken at your desire and request, in the months of August, and September last past; a view and survey of your Haven, Piers, *Braidon Waters*, the rivers *Wavenny*, *Yare* and *Bure*; discharging themselves therein, and the adjacent parts of the Country, of which a correct map (as taken in the month of April last by Mr. *Richard Paton*) is hereunto annexed.

FROM the several views, measurements, soundings, and observations, which I have taken, I am enabled to acquaint you in this following Report, with the true state of your Haven, and to point out the methods which, after mature reflection and consideration,

do appear to me the most eligible to restore your Haven to its former good Condition, and even to improve it, especially at its entrance, without attempting to force nature, or entering into dubious, and expensive undertakings, in order to which, and for the greater perspicuity, give me leave Gentlemen to divide this Report under the three following heads.

FIRST, To relate, in as few words as the subject will admit of, the true state in which I found the Barr, Haven's Mouth, Bason, Keys, Wharfs, Bridge, Braidon Waters, and the three Rivers, together with my observations and remarks thereon.

SECONDLY, To point out, what I humbly conceive you ought to avoid, or not to do.

THIRDLY, what methods, in my humble opinion, ought to be pursued, not only to obtain the desired restoration of the Haven, to its former good condition, but also what may be done towards the improving it still more, as far as the nature and circumstances of the place will permit.

FIRST, I carefully viewed and examined the Haven's Barr, which during all the time of my survey, reached quite across the Haven's Mouth, at the short distance of a cables

bels length, or about 200 yards from the Pier Heads; I observed with concern the dangers, and difficulties attending the Ships and Vessels getting in and out of the Haven, over the said Barr, tho' the weather at that time was very moderate, and from what I saw then, I easily conceive how much more dangerous the said Barr must be in more stormy weather.—I found this Barr to consist of some *Beach-stones* or *Shingles*, but chiefly of a very fine loose sand, the same as all the shoals, and banks which lie in and about *Yarmouth* Road, and all the adjacent sea coasts; from thence, and all other circumstances, such as the winds blowing on, or off the shore, or along it, and the greater or lesser quantity of land waters, emptying themselves out of the Haven's Mouth, I plainly perceived that this Barr must often change its size and position. I found it accordingly very different from what it was, in April last, and was informed it was almost daily altering, as to shape, size, situation, and shoalness.

SECONDLY, I took particular notice of the position and construction of the old south, and north Piers, and of the additions made to them since, I found the old south Pier still filled up and tight, and therefore still answering the chief intentions for which it was built, viz. to hinder the waters of the three

rivers and the *Braidon* from running to the southward, as they used to do before under the highlands, and to turn the stream of the ebbing waters to the eastward ; in order to keep the mouth of the Haven as open and as deep as possible ; but this last intention is at present frustrated in a great measure, by the slight construction, and bad condition, in which I found the new or additional south Pier, thro' which a great part of the ebbing waters escapes to the south east of the mouth of the Haven, the new south Pier at present being only useful as a platform, or stage, on which by the help of the capsterns there erected, men are enabled to help the Ships in, over the Barr.

THIRDLY, I examined the remains of the old north Pier, now almost buried in the sands, which fill up above half the chaunel between the Piers, and also the new additional north Pier, on which the *crabs* and *capstanes* are placed, for the heaving in of Ships over the Barr, and I am clearly of opinion, this is the only use and service that either the old, or the new north Pier are at present, or ever could be of : I shall speak more largely on them, in the last part of this Report.

FOURTHLY, I examined the construction of that wharfing round the elbow of your Haven's Mouth called the *Brush*, and find it suf-

sufficiently well performed to answer the purpose it was made for, tho' not placed so well as it ought to be, as I shall shew hereafter.

FIFTHLY, I took a view of the *Fort*, but having no *Encomium* to bestow upon it, all I shall add to this article, is, that it must be looked upon as a battery of 15 guns, which, it is to be hoped, will be always kept in good order, and supplied with a proper quantity of ammunition, and all necessaries.

SIXTHLY, I also viewed and examined the south and west shore of the Haven's mouth round the Fort, and was sorry to find them so incumbered with stakes and jetties advancing even beyond low water mark, and consequently of great hinderance to the land water's scouring the Haven's mouth.

SEVENTHLY, I observed with pleasure the rise, and course of the tides, through the said Haven's mouth, and found the flood tide running up the Haven between the Piers, at the rate of full five miles an hour, and the latter end of the ebb, when swiftest, running out between the Piers at the rate of full five miles and a half an hour, all which I deduced at a *medium* of several observations; as to the rise of the tide at the Haven's mouth, it may, at a medium, be computed about 6 feet perpendicular, it being seldom more than 8, or less than 4 feet.

EIGHTHLY, I was sorry to find that the *Brush* wharfing, being placed too much in the land, and making the turn of the Haven towards its mouth, much too short, the shoal of sand over against it is advanced from the Fort side, so very near the said *Brush wharfing*, and so much contracts the channel, as to render the navigation at that place very difficult and dangerous; Ships being frequently aground on the said shoal.

N. B. The haven's mouth being the place, in my humble opinion, where the greatest efforts for restoring the haven to its former good condition, (and even improving it further if possible) ought to be made, I took a particular survey thereof, a correct draught of which I have annexed to this Report.

NINTHLY, The next subject of my survey, and observations, was the Haven itself, contained between the *Brush Wharf*, or the *Fort* and *Yarmouth Town*, and I observed with a great deal of pleasure its considerable length of near two miles, convenient breadth, and depth of water, even very close to low water mark, all which make it a most safe retreat and wintering place for a very great number of ships and Vessels, at the same time; and tho' these Ships and Vessels are not of the greatest draught of water it is with such Ships and
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Vessels that above three fourths of all the Sea Trade is performed all over the world: Therefore this haven, in my opinion, wants only an easier coming in and going out, and to be kept from being silted up. In my frequent goings up and down this haven, I could not but take notice of several jetties extending from shore even beyond low water mark erected for the shipping off goods, or for the conveniency of landing with boats and passengers, two of these are near the Fort, and several others on the opposite shore further up, all which are very prejudicial to the free course of the tides, and land waters.

FURTHER up, at the lower end of what is called the *Ballast-Key*, I examined the Engine for taking up sand and mud, in all its parts, and afterwards had also a view of the model of it in town, from what I saw of its construction, and from what informations had of its performance, I think it a very good Engine; I shall mention hereafter how and where, in my opinion it ought to be used, and shall conclude this article with observing, that as almost all the different motions of this Engine (which being pretty much complicated, are not a few in number) are performed by wheels and pinions. I should suspect the contriver thereof to have been either a clock-maker, or a jack-maker

and that from the make and construction of the paddles or buckets which rake the bottom of the river, when the Engine works, it does not appear to me that any hard gravel or clay, or even solid earth, could be effectually taken up by this Engine.

TENTH, Proceeding further up, the next object of my survey was an exceeding slight kind of wharfing which I observed on both sides of the haven, but more of it, on the east side, made up of a few stakes and deal boards; these wharfings I was informed, were intended for a double service, to preserve the main lands, and roads on each side, from the lashing of the waves in rough weather, and also to contain the stuff which the Engine was to take up, and keep it from returning into the said haven, but the slight deal boarding fastened to the stakes of this wharfing, not being carried into the ground something deeper than low water mark, as it ought to be; on the contrary, being left off at some distance, from the surface of the ground under it, whatever sand, mud, or silt, is thrown beyond it, will soon be washed out again, thro' that opening at bottom, and the main land, or the road on each side of the haven, are now almost as much exposed, as if no such trifling wharfs had been erected.

ELEVENTH,

ELEVENTH, I could not help also taking notice, that what is allowed to Ships for ballast, being chiefly small sand which I observed to lay in heaps, very near the water on the said *Ballast Key*, fresh gales from any point in the eastern, half of the compass must in dry weather blow a considerable part of this sand into the haven, which being carried up and down by the tides, must contribute, (at least in some measure) to the silting up of the haven, and increasing its shoals ; but I shall in the last part of this Report, propose an easy remedy to this evil.

TWELFTH, I now come up to that part of the haven which is the most beautiful, as well as the most in use, ranging along the west side of the town of *Yarmouth*, and parted from the houses by one of the finest, and most convenient Keys in the whole world. I was mightily pleased to find so much depth of water in the channel of this part of the haven, (which for distinction sake I call the *Bason*, or the *Pool*,) and so good a stream to keep it clear.

THIRTEENTH, I am obliged to mention that I found the wharings of your Keys, and those on the opposite shore, in a very bad condition, great part of them in want of considerable repairs, some quite ruined, so that
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till repaired, part of the very Key will be daily washing and crumbling into that beautiful and most useful Bason.—Moreover such parts of the Key wharfs as are tolerable good, are built in several bends and angles which are very prejudicial, by giving room to the mud and silt to lodge there, and accordingly I observed a considerable quantity of that kind of silt, almost all along the wharfing of the Key on *Yarmouth* side, and was credibly informed that it was much increased of late years. This is no more than a necessary consequence of the decay of the wharfs, and the improper manner of repairing them, and is of considerable prejudice to the shipping, which cannot approach to the Key at present as they did heretofore.

FOURTEENTH, The next thing which offered in the course of my survey and observations, is *Yarmouth Bridge*, which I found so far decayed in all its parts above low water mark, as well piles as upper works, that I do not conceive your communication for carriages with *Suffolk*, can be preserved long without very considerable repairs, or rebuilding it quite new; from my own observations, and the best informations I could procure, I find that the rise of the tide, under the Bridge, cannot be computed (at a mean) at more than three feet perpendicular, it seldom rising less than one foot on extraordinary neap tides, or
more

more than five feet on extraordinary spring tides.

FIFTEENTH, I could not help taking notice, that the river *Bure*, commonly called the *North River*, enters the *Braidon* in a direction almost contrary to the course of the waters of the two other rivers ; such a direction must almost necessarily occasion that shoal which is now in the *Braidon*, just below the entrance of the *Bure* into it, and having been informed that it has increased considerably since the wharfs and building near the entrance of the *Bure* into the *Braidon* have been advanced into deeper water, if upon proper enquiry the truth of this should appear, all such advanced wharfs ought to be looked upon as very prejudicial encroachments, and removed if possible.

SIXTEENTH, The next subject of my observations, was that large receptacle of waters called the *Braidon*, besides the advantages accruing from the Fish and Fowls, which it affords in plenty, it is certain that all such large receptacles of waters, situated above harbours, in and out of which the tides have a free ingress and regrefs, are always of the greatest advantage to those harbours, in receiving and containing large quantities of waters, part of which serves as back waters jointly with that of the rivers, which empty themselves thro' it,

it, towards scouring the haven, especially at the mouth thereof, and towards preserving a good depth of water, as I shall explain the use of the Braidon more at large in the latter part of this Report; I shall only observe here, the rise of the tide in this large lake, must be greater or less in different places, according to their distances from the haven's mouth, it may be computed, at a mean, at about two feet perpendicular, all over the said Braidon, it being seldom less than one foot in neap tides, and seldom more than three feet in spring tides.—I found the channel thro' which the navigation of the *Keels*, and other Vessels is performed, between the haven and the three rivers, convenient enough for that purpose, excepting only over-against *Red Coat Point* and thereabout, where for want of a sufficient depth at low water, some of the vessels cannot pass without difficulty; to remove which, I shall mention the only remedy I can think of hereafter. I was informed that of late years the Braidon has been considerably silted up, the shoals therein having increased, and remaining dry or bare longer than they did; but this happens to all rivers and streams after a course of dry years, and the reverse, viz. the shoals growing less, and the depth of water increasing by the scouring of the rivers, after a course of wet years.

SEVENTEENTH, Under this last article of the first part of my Report, I shall lay down promiscuously, all the material observations which I made on the three rivers, the *Wavenny*, the *Yare* and the *Bure*, the first and last of these I carefully viewed, and observed to the extent of *Yarmouth Jurisdiction*, viz. up to *St. Olave's Bridge*, and up to *Wey Bridge*, the second I carefully observed not only up to *Hardley Cross*, (the extent of that Jurisdiction) but quite up to the City of *Norwich*, I found in general, each of those three rivers very beautiful, and very commodious for the Navigation, of a very considerable breadth, and having each of them great depth of water, not only in the best of their channels, but even very close to the shores or banks, from my own observations, and the best informations I could collect, I don't find them obstructed with any considerable shoals, not even at the points of their several reaches, or turnings, where it is very common to meet with such shoals, but I found them indeed in several places too full of rushes and weeds. As to the rise of the tides in these, as in all other tide rivers, it is more or less, in different places, according to their distances from the Sea; but in order to fix upon some place, that may serve as an average on the whole, I found from my own observations, and the best informations I could get, that about the
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extent of *Yarmouth* Jurisdiction up those rivers, viz. at *St. Olave's Bridge*, *Hardley Cross*, and *Wey Bridge*, the rise of a common tide cannot be computed at more than one foot six inches; it flowing seldom less than one foot or more than two in those places, and less and less higher up, to the utmost extent of the impulse which the flood tides receives from the Sea.

I determined also (at a mean) from several observations, the greatest velocities of the Stream of each of those rivers, near their entrances into the *Braidon*, but was sorry to find them also very gentle, the *Bure* is the swiftest of the three, and the *Yare* the slowest, and none of the three runs much more, or much less, than about one mile an hour; I plainly saw the reason of so gentle a current in all those rivers, by observing how low and level is the greatest part of the lands, thro' which they pass, which in many places are not higher, not even so high, as the high water mark of spring tides, and in the driest places, but a very few feet higher, and therefore it is no wonder that great part of those lands are so often overflowed by extraordinary tides, and considerable land floods. I cannot conclude this article without observing, upon the whole, that the *Yare* appears to me the finest and best of these three rivers,
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and of the greatest consequence, for I found it very navigable for considerable vessels quite up to the City of *Norwich*, and am informed that it is still so for many miles up higher into the Country, and up into other streams and rivers which empty themselves into the *Yare*, to the inestimable advantage of that large City, and all the neighbouring Countries.

HAVING gone thro' the first part of my Report, which was to contain the result of my view and observations.

I now proceed, GENTLEMEN, to the second part, wherein I intend to lay before you the absurdity of some notions, and the Impropriety or Impracticability of several schemes or projects that have been mentioned to me more than once ; with my reasons for exhorting you in the most earnest manner, never to give your consent for putting any of them into execution ; I think it is proper that this part containing what (in my humble opinion) ought to be avoided or not done, should proceed the last part of this Report, wherein I shall propose to you what (in my humble opinion) may and ought to be done ; because the first step towards doing what is right, is undoubtedly to avoid doing what is wrong.

EIGHTEENTH, In the first place, Gentlemen, you ought never to entertain any notions of altering the place of the mouth of *Yarmouth* haven, in order to have it either further or nearer the north or south end of *Yarmouth* town, for it appears by the records, and the havens books, that between *Edward* the Confessor's reign, and the year 1560, when the first south pier was ordered to be built, that there have been eight different entrances into *Yarmouth* haven, and that the present has been the best, and continued the longest in a good condition without a barr; to the restoring of which (or to the improving it into a better) all possible endeavours ought chiefly to be employed.

NINETEENTH, The next absurd notion (which ought to be for ever rejected) is, that *Yarmouth Haven* can ever be improved, so as to admit ships of war, or of very considerable draught of water, or that dry docks, can ever be constructed about the Haven, wherein large ships might be built or repaired, which upon the opening of some gates, the tides would bring in, or fetch out, whereas the rise of the tides on your coast, and in your haven, is not considerable enough for any such undertakings; notwithstanding which the haven is certainly good enough to promote a very extensive and beneficial trade,
and

and (with due care) it may be further improved; of which more hereafter.

TWENTY, Another notion, which in my opinion, ought also to be banished out of the minds of all reasonable people, is, that there may be a probability of certainly preventing at all times, the mouth of *Yarmouth* haven from having any barr, or shoals before it, on which it must be observed, that all rivers whose beds are not entirely rocky, bring down with them some silt, or earthy particles, from the lands which they run over, and that the velocity of their streams being not only much retarded, but entirely stopt, very soon after they enter into the Sea, whatever those rivers bring must necessarily drop thereabout, in shoals and bars, some of which are fixt, and others moveable, according to the different nature of the soil, and other circumstances, attending different rivers; but besides this general reason for there being frequently a barr, or some shoals more or less, before *Yarmouth Haven*, it is well known (at least to all seafaring people on your coast) that your barr, and all the shoals and sands in and about *Yarmouth* road and coast, are not altogether brought ought of the lands, for all or most of them consist of some *shingles* or *beach stones*, but chiefly of a fine small sand, very loose and easily moved about by the winds,

tides, and land-floods, which according as those different causes act jointly, or contrary, must necessarily change the shapes, sizes, and situations of all or most of those sands, as well as that of Yarmouth Bar. Now it is impossible, since several of these causes, which contribute towards forming the said bars, shoals, and sands, are not at all in men's power, that your bar can be always and certainly removed, by any possible disposition of your land-waters, and back-waters, which are only one of the several efficient causes that contribute towards the making or the removing those bars and shoals. I shall, in the last part of this Report, offer you my opinion, as to the best method of applying your land-waters and back-waters, so as to obtain the most that can be expected of them, towards the removing the said bar and shoals, or at least towards keeping some passages open through them.

Objections against the South pier being lengthened.

I cannot leave this subject, without taking some notice of a project which has been mentioned to me, as an infallible, or at least a very probable expedient to remove this bar; but (in my humble opinion) it ought never to be put into execution, since it would be attended with a very great expence, require a great deal of time, and at last no ways answer the end. This project is, to lengthen the
South

South pier of *Yarmouth Haven* further into the sea, to place the additional part so as to point towards the North-east, and lastly, to make it so tight all the way, as to force the course of the land or back-waters to the North-east, by which means the proposers expect that the land or back-waters, so directed, will certainly be able to carry away all the bar and shoals which, as they say, are brought to the haven's mouth chiefly from the North-east by the tides of floods. It is certainly not only possible, but practicable, to put this scheme into execution ; though, I am afraid, that few of the persons who propose, or approve, or espouse it, are aware of the time, trouble, and expence, that must attend such an undertaking ; but I am convinced that, from the execution of this additional pier, the bar and sands would not be removed, and the entrance of the haven would then be more difficult than it is now ; for supposing it were true, which I am far from believing, that the bar is chiefly brought on by the flood tides from the north-east, the consequence necessarily attending the execution of this scheme would be, that the force of the land or back waters, already greatly lessened by the short turn they must take round the *Brush Wharf*, from what it would be if it went out at sea, without taking so short a turn, would still be lessened much more by

meeting another angle or bend at the end of the present new South Pier; and though the land or back waters would go on then in a direction towards the North-east, it so happens that at the time those waters can act at all, viz. at the latter end of the ebb, the moment they should have passed the end of this new *South Pier*, they would be checked by the ebb stream setting to the North, whence it is evident to any person that understands the effects resulting from two forces acting jointly in different directions, that the action resulting from these two forces must be in a direction tending to some point between the North and the North-east, and exactly due North North-east, if the force of the land waters was always equal to that of the ebb stream; but as the force of the land waters would grow weaker and weaker, the further it went from the pier, and that on the contrary the force of the ebb would remain the same, the direction of the back waters would soon be nearer to the North than North North-east, and very soon after bend still more to the North, along the shore, where only there would be a possibility of any channel being kept open, and such a channel would make the entrance of the Haven still more difficult, and still more liable to be choaked up, and altered by the flood tides, than it is now, especially with fresh gales from
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the North North-west to the North North-east.

TWENTY-FIRST. The next caution which I think my duty obliges me to give, is to prevent by proper informations, some persons confounding or mistaking what are properly the back waters of Yarmouth Haven, with what are not so. To avoid this it must be observed, that in all such parts of the rivers or streams where the tide never reaches, all the waters that run down may be looked upon as land waters or back waters ; but in any place where the tides are felt, what can properly be called land waters or back waters, is only the *overplus* by which the waters that passes or run down in the ebb towards the sea, exceeds the quantity of waters that passed or were forced up during the preceding flood.

Now as the tides of flood and ebb, in all rivers, are not equally strong, that is, have not the same velocities, nor indeed have either of them the same velocity from beginning to end, it is not easy to determine this quantity of back water very exactly ; but for an average sufficient for all practical affairs and computations, the quantity of back waters which passes through at any one place, may be computed to be not very different from what passes through that place, at the latter

end of the ebb, during that time by which the ebb tide exceeds the time of the preceding flood. For example, at *Yarmouth Haven Pier Heads*, where the flood tide is, in round numbers, usually five hours making up, and the next ebb about seven hours going down. The water that goes cut at the Haven's mouth, during the two last hours of the ebb, is nearly all that can be properly called the land waters or back waters. This distinction, well understood, will shew the reason why there are many places which, like *Yarmouth Haven*, have a great deal of water above them, and yet, on account of a scanty rise of the tide, or rivers running but slowly, or other circumstances, have but little useful back water for the scowering of the channels and mouths of those havens or places.

Locks or
Sluices.

TWENTY-SECOND. The next scheme or project, Gentlemen, which I can never caution you too much against, is the erecting of locks and sluices across your Haven, or across any of the rivers. I know very well that such schemes appearing at first view plausible enough, and carrying along with them the appearance of a double advantage, viz. The increase of back water to scower your Haven's mouth, and also the keeping extraordinary spring tides from overflowing some low lands, is the reason why such projects meet with abundance

abundance of friends ; but I hope that those persons will be no longer of the same opinion, after reading and considering what follows.

THERE are several kinds of sluices, all of them invented within two or three hundred years, and most of them by the *Dutch* ; some to keep the sea out, and at the end of the ebb, to let out their land waters ; some to receive and keep in the sea or tide waters, to serve as a back water, either alone or jointly with some land waters, by being let out suddenly at low water ; some are so constructed as to be able to answer either, or both these purposes ; and lastly, there are other kinds of sluices, of the greatest service in making the inland rivers navigable, so contrived as to let vessels pass through, and to rise or depress them from the level of one part of the river to the next ; such sluices are called in the fens *Penstock Sluices*, and in most other parts of England *Locks*. Now, as to the practicability of this project, it must be observed, that the only places where any intelligent person would place such sluices, must be either at the upper end of your Haven, above the bridge, where it could be made to pen up all the waters brought by the tide into the *Braidon*, and the three rivers, besides the land waters, or else, if that be thought too difficult

cult, or too expensive an undertaking, the most likely place for such sluices would be at the mouths of all the three rivers, just above their entrance into the *Braidon*. Of these two situations, the first is certainly the best ; since not only the extraordinary high tides could be kept from all your low lands, even those round the *Braidon*, and all the tide waters brought in by the flood tides into the *Braidon*, and the three rivers, might be employed jointly with the land waters, as back waters.

BUT let it be considered that the space to be sluiced in that place, is near 200 feet wide, and near 25 feet deep at low water, in the middle, and the nature of the soil at the bottom and sides, being (as I was informed) mostly sandy, the difficulty and expence that would attend the execution of such a project would be immense ; for 'tis my duty to inform you, that the building of good and substantial *Locks* or *Sluices*, especially in such depth, and in such sorts of ground, is the most difficult part of all practical engineering, the most expensive, the most dangerous, the most liable to unforeseen and often irretrievable accidents, and in such a place as I am now speaking of, extremely difficult to be repaired or mended, when the works first erected should come to decay. To this must
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be added, the expence of a *Lock* or *Penstock Sluice*, for the sake of navigation, which it would hardly be possible, and not at all adviseable, to construct in any part of the sluices, that should bar your whole Haven, and consequently such a *Lock* must be erected upon a *Side Cut*, which must be dug out either on *Yarmouth* side, where there is but little, if any room for it, and what must be very dear ; or else on the opposite side, where the ground seems to me very indifferent for it, without great additional works to secure the foundations, as well as the bottom and sides. What I have now mentioned of the difficulties and prodigious expences attending the sluicing your Haven, holds equally true, if the sluices were erected at the mouths of all the three rivers ; for though the depth of water is not so great there as at the upper part of your Haven, it is still very considerable in each of them, and the breadth of those three rivers, taken together, much larger than the breadth of your Haven, and the nature of the soil, as I am informed, not much better, to all which must be added, in this case, three *Side Cuts*, and three *Locks* or *Penstock Sluices*, one on each of the rivers, for the sake of navigation.

BUT besides my putting you on your guard, as to the difficulties and expences attending

attending either of these projects, I must next inform you how little good they could do at most, and on the contrary, how much mischief they would certainly occasion, either of these two projects would indeed increase your back water, but not so much as some may imagine; for supposing every thing as much as possible in favour of them, that is, supposing the real natural back water to be what runs out for the last two hours at the end of the ebb, and that it runs all that time at the rate of five miles and a half an hour, which it certainly does not, and that the tides rise to the utmost of what I have mentioned in the 7th, 16th, and 17th articles of this Report, I can make it appear to any Person sufficiently versed in these kinds of computations, that all the waters penn'd up in the *Braidon*, and three rivers, would not increase the velocity or the duration of your present back water, in the proportion of two to three, and that if the sluices were placed at the mouths of the three rivers, the back water would not be improved in either duration or velocity, in the proportion of four to five, nor perhaps in that of five to six, either of which, in my humble opinion, is not worth while to be sought after, at so great a risk and expence, especially if the danger you would then certainly be in, of utterly losing your Haven in a few years, instead of improving it, be also
taken

taken into consideration ; for in general, though *Locks* and *Sluices* are one of the most useful inventions of the moderns, and of infinite service to mankind in the making of inland rivers navigable, they ought never to be placed in the way of tides, without the utmost necessity. In inland rivers, indeed, where the waters are kept stagnating, or nearly so, upon different levels from one lock or sluice to the other, it is observed that the locks or sluices are of no prejudice to the rivers all the way above the lowest lock, if there be more than one, but it has also been often observed, that *Sluices* or *Locks* placed within the reach of the tides, have occasioned the rivers or streams on which such works were erected, to silt up from the sea to the said works. 'Tis chiefly owing to these sorts of works, together with the embanking of marshes injudiciously, that the town of *Rye*, and the town of *Wisbeach*, are, from sea-port towns, become, as it were, inland towns, having in a great measure lost their Havens ; and, in my opinion, there is no need of looking out for more reasons of what is confirmed by experience than the following one, viz. that nothing is more certain than that the greater is the quantity of water, and the oftener it passes and repasses through any channel, the cleaner and deeper that channel is kept, whence it happens that all
rivers,

rivers, especially tide rivers, are more or less filled up, after a course of dry years, and that they recover, and often increase in their depth, after a course of wet years.

I AM sensible, however, that the keeping low lands from being overflowed by raging spring tides, is an object worthy of attention, especially to the owners thereof; but if I am not mistaken, the low lands about the *Braidon*, and the three rivers, are oftener drowned by the land floods than by the tides; nay, if it was otherwise, I presume all good people will join in my opinion, that it is better that some lands should be now and then made too wet, by the tides coming in, than that, by the tides being shut out, the Haven should be in manifest danger of being lost.

Were it possible, indeed, to restrain only the very top of those raging tides, which only do mischief to the lands they overflow, without improving the back waters, by reason that little or none of the waters flown over those lands do return towards the sea, but remain there stagnating, till evaporated by the action of the sun and winds; I say, where such a thing is practicable, that restraint is productive of good, instead of evil; but there are very few situations that will admit of it, and I have not met above one in
twenty-

twenty-five years practice and observations. I think upon the whole, all locks and sluices, in your case, the most pernicious of all schemes; therefore I earnestly advise, and humbly hope, That if the town of *Yarmouth*, the city of *Norwich*, and all the neighbouring countries, who are concerned in this Haven, have any regard to their own present and future welfare, they will always steadily oppose and hinder, to the utmost of their power, the execution of all such works.

TWENTY-THIRD. Another scheme has also been mentioned to me, which I think it my duty to caution you against, lest a great deal of time, trouble, and money, should be thrown away to little or no purpose at all; and this is, to open some channels of communication between all the *Meers*, *Lakes*, or *Broads*, in your neighbourhood, and some of the rivers emptying themselves into the *Braidon*; by which means, the persons who propose this scheme are (if not certain) at least in good hopes, that there would be a considerable increase of back waters towards the more effectual scouring of your Haven, and removing the Bar from before its mouth. A laudable proposal indeed! if the situation of all those *Broads* were not so low as they are, and if those *Broads*, or collections of waters, were any thing more than the draining of the rain waters,

*Meers
and
Lakes:*

waters, with some few inconsiderable springs or rivulets. In my views of the *Bure* and the *Wavenny*, I took notice of two small channels overgrown with rushes and weeds, emptying the waters of two such Broads into those rivers; the one they called *Muckfleet*, the other *Fretton Decoy*; and I heard some persons affirm, that were even only those two channels opened, so as to admit the free ingress and egress of the tides in and out of those two *Broads*, great benefits would accrue therefrom to your Haven.

Now, though it is certain from the very first principles of hydrostatics, confirmed by daily experience, that all reservoirs or receptacles to receive the tidal flood, are certainly of great service to increase the back waters of any harbour, yet the chief thing to be enquired into, before any such reservoir be dug out or made use of, is, to what height above the low water mark, at their mouths, the tide is likely to rise up into them, since the greatest benefits to be expected are not from the largeness alone, or from the number of those *Broads*, nor from the depth of their waters; because all the waters contained in them, below the low water mark, at their mouths, is of no more use than so much dry land; but from the height to which their waters are usually kept up above the said low water

water mark, by springs or rivulets, or else from the height to which the tides would rise up into them. Now, from the low situation of all the *Broads* in your neighbourhood, it is not very difficult to conceive what would be the consequence of not only *Muck-fleet* and *Fretton Decoy*, but several other *Broads* being made to communicate with your rivers, for the result would only be this; if the surface of any of them lay lower than the surface of high water, at their mouths of communication with your rivers, in less than twelve hours, they would be filled to the same level as the rivers at high water; on the other hand, all those *Broads* whose surfaces are higher than that of high water, at the mouths already mentioned, would in less than the compass of two tides, or about twelve hours, empty themselves into the rivers, till their surfaces should all be about the same hanging level as the surfaces of those rivers, and ever after would afford but a very small addition of back waters to those very rivers, for the whole of it would only amount to that small remainder, of what the tides could bring up into them at every flood, which should be there left, within about two hours before low water; and since the tides rises but to a very inconsiderable height up into your rivers, my humble opinion is, that the greatest benefit that ever can be expected

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from

from the opening of communications between all the *Broads* about your country and the three rivers, would at most be very inconsiderable, and will never answer the expence.

Cutting
the North
River.

24. THE last project or scheme which I have heard mentioned, for the improvement of Yarmouth Haven, is that of cutting a new and much shorter channel for the *Bure* or *North River*, into the *Braidon*, at a place called *Scar Gap*; now supposing it were done, the consequence would be, that it would be high water at every place in the *North River* above it, where the tide reaches, a few minutes sooner than it happens now, that the river is obliged to take a round about course by the north east end of *Yarmouth Town*, but the tides would not thereby reach one inch further up, or rise at any place one single hairs breadth higher, because the forces of the tides are always as the *Impulse* they receive from the sea, which enable them to rise into the rivers to a certain perpendicular height at every place where they reach, and no higher, whether the tide is a longer or a shorter time in reaching up to it, and therefore since the tides would rise no higher, nor flow further up into the *Bure*, by the new cut proposed at *Scar Gap*, than they do now up the present channel, and moreover, that the velocity of the ebbing waters of the north river would be

be as soon lost by falling through the new cut, and dispersing themselves into the *Braidon*, as it is at present, I believe all unprejudiced persons will be of opinion with me, that such cut would not only be of great prejudice to the north east end of *Yarmouth Town*, to all the buildings and lands above it, as far as *Scar Gap*, and that the money that must be laid out in indemnifying the owners for their loss, in the purchase of the lands for the new cut, in the making this new channel, and in stopping up the old, should only be money thrown away.

GENTLEMEN, having now gone through the first and second parts of this report, I shall proceed to the third and last part, wherein I propose to lay before you what steps (in my humble opinion) ought to be taken, and what works should be put into execution, as soon as possible, in order to preserve and improve your haven.

25. FROM a careful view and survey of your present haven's mouth, the nature and situation of the neighbouring parts, and all other circumstances, it plainly appears to me, why till the land waters and floods, with the returns of the ebb tides, were effectually hindered from escaping along shore to the southward, towards *Lowestoft*, under the high lands

lands of the coast, and were turned right out to sea, by the building a south pier, all former havens were lost, or rendered useless in a few years; in which opinion I am confirmed, by some abstracts of your records and haven books, which I have seen, which shew that the first substantial south pier was not begun before the year 1560, that an open north pier was constructed soon after, and that while they were both kept in good order, and in the same state and condition in which they were first built, the haven was in as good condition as could be wished, and remained without any considerable bar for near 100 years, consequently nothing appears to me clearer, than that your chief care ought to be to repair in the first place, the new south pier in a strong and substantial manner, so as to answer those very purposes for which it was built, viz. to hinder the waters from passing to the southward, and to direct them right out to sea, for clearing the mouth from bars and shoals as much as possible, or at the least, for keeping open some passages thro' it.

THE method which I recommend to be followed in doing this, is the following; first, to draw out all the large piles round the said new south pier, which shall appear too far decayed, and to drive new stout caken ones in their stead, something deeper than the old ones

ones were, with a weight called by some a *Ram*, and by others a *Bell*, not less than 12 or 14 hundred weight, and the strokes not less than 15 or 18 feet high at an average. Secondly, as the row of split piles, which are driven in the inside of this pier, the whole length thereof, nearly parallel to its sides, but (I know not why) twice as near to the north than to the south side, is now greatly decayed, and several of the piles washed out, the said row of split piles ought to be put in thorough repair, and made as tight as possible. Thirdly, in the inside of this new south pier, close to the outer piles on the north and south sides, and in the middle line between the present row and the south side, three other rows of split piles should be driven, at least 10 or 12 feet deep below the low water mark. Fourthly, at the east end, and close to the west side of the rows of piles, which support the cross beams of the pier, cross rows of split piles should also be driven, as close to one another as possible, to the same depth as is just now mentioned, by means of these four rows of split piles, viz. three new ones, besides the old one mended, each of which will then extend the whole length of the pier, and by means of the several cross rows of split piles, the whole cavity of the new south pier will then be divided into several smaller cells or cavities, near-

ly square or oblong square, as I have represented in No. 2, of the draught annexed, which is edged with blue filk; wherein, for distinction sake, part of all the present old works are marked in Indian ink, and the new rows of split piles, which I propose, are marked in yellow. Fifthly, as no care or expence ought to be spared to make this additional south pier, as well as the old south pier as tight and as strong as possible, I do not think all these rows of piles sufficient, but would recommend to take up all the sand out of those cells or cavities, in the pier, to low water mark, and even some feet lower, and to have them entirely filled up, not with sand or rubbish, but with such a substance as will suffer no part of the sea waters or the ebbing waters, from gulling under or passing through. After mature reflections upon the materials that can most conveniently be had, and employed for this purpose at reasonable rates, the best and cheapest I have to propose is a kind of stone-mortar, made up of a mixture of *Beach Stones* or coarse *Ballast* worked together, before it be put into those cells, with the strongest lime that can be had at a moderate price: the best size of beach stones for this purpose are, none to be less than a small nut or filberd, and none much larger than a hens egg; but without being so nice as to the picking of them, common large
 coarse

course ballast, will do full as well, provided it be not intermixed with too much sand, or other small stuff; as to the lime, it is certain that *Dutch Tarris*, mixt in a proper proportion with common lime, would be the best to work up this stone mortar, but as it would make this part of the work very dear, I shall propose to you another sort of lime, which I have reason to think will do full as well, and this is *Shell Lime* mixed with other lime, in a proper proportion, which the persons employed about this kind of mason's work will soon find. This kind of lime, viz. *Shell Lime*, has been but lately made in any quantity near *Gravesend*, what was used of it in England before being chiefly imported from *Holland*, where great use is made of it in works of this kind, as well as in the *East Indies* and several other places; and I have reason to think that it will answer very well for the purpose of filling your pier, as it is to be had near the mouth of the *Thames*, and may be brought to the very spot by shipping, it will come at a very reasonable price. If I had not this *Shell Lime* to recommend in the stead of *Dutch Tarris*, I had mentioned some sorts of strong stone lime, but as there is none to be had near you, nor indeed can any be had so good and so reasonable. I forbear adding any thing more to this article of the lime, than to observe that even the best of

Chalk Lime alone will not be good enough for this purpose, and that great care ought to be taken, least the *Shell Lime* which I recommend to you, be not too much weakened by using with it too great a proportion of chalk lime or even stone lime, I doubt not but several readers will be surprized at this *Stone Mortar*, or mixture of *Beach Stones* or coarse *Ballast* and *Shell Lime*, which I propose for the filling of the cells or cavities of the south pier, but the use of it is far from being new or in any wise extraordinary. The *Romans*, and since them the moderns, having made use of it frequently and with great success, and little expence, of which I could mention, if necessary, a great many instances, and quote about it the authorities of many celebrated authors, besides that of *Vitruvius*. Moreover this method is particularly adapted to the making of good and cheap work, in the affair of filling your pier, because the whole cavity being divided into several cells, they are severally managed with great dispatch, conveniency and little waste, the split piles hindering the water (in a very great measure) from washing away the best and most fluid part of the lime, contained in this *Stone Mortar* or mixture, from among the *Beach Stones* or coarse *Ballast*, before the whole has acquired some hardness. What I have to add in relation to the new south pier,

is,

is, that the repairs, and the new works which I proposed (if they be duly managed) will not hinder the use of the capstanes erected at the end of it, for the heaving in of ships over the barr, even during the time that these works are performing: Now whether it ever was absolutely necessary to lengthen either of your old piers, or the south pier in particular, is not at all clear to me, from the abstracts which I have seen of your haven's books, and town records, neither do I think a minute inquiry into it at present, of any great service, my humble opinion of this new south pier, being upon the whole, that since the sands have gathered to the south side very near as far out as the head, and that without such a pier it would be very difficult to heave in the ships, till the sands are removed, this new south pier ought to be preserved, and improved by proper Repairs and new works as explained above; but I cannot advise the lengthening of it further into the sea on any account, either in the same direction, (which I think the best) or in any other; since if any such addition be made, tight and close, as the south pier of your haven should be, all the way to the end thereof, let it be continued ever so far, the ebb tides and winds will in a few months heap on sands on the south side thereof, which in time will reach quite to the head.

26. FROM what I could observe of the construction and present condition of the *Old South Pier*, and of the wharfing round the lowermost elbow of the haven, called the *Brush*, and from all the informations I was able to collect about them; it appears to me that the said old south pier, was judiciously placed, as to its direction, that is, right out to sea, and exactly in the middle between the directions or the settings of the tide of flood and ebb, that it was certainly built in a strong and workman-like manner, and appeared to me still in a tolerable good condition; therefore all that I shall advise on this head is, that after the new south pier has been repaired as I proposed, the old south pier should next be carefully examined, and put into thorough repairs, by taking up the large piles in front that should be found decayed, and new ones driven in the room of them, the decayed logs and brush-wood behind them should also be removed, and new put in, observing always in this kind of wharfing, to use next in front the stock ends of the largest logs that can be had, and to fill their interstices as close as possible with lesser stuff or brush wood, and what I have now mentioned in respect to the old south pier is also to be observed in respect to the repairs of the *Brush* wharfing round the elbow of the haven, which ought to be taken in hand, next to those of the old and new south piers.

THE said *Brush* wharfing appeared to me well enough performed as to workmanship, and to be still in good order, but as to its situation and shape, it bends in a great deal too much to the south west, which occasions a considerable part of the force and velocity of the ebbing waters to be lost, by meeting with so direct an obstacle, and a great quantity of sand, mudd, and other silt, as thereby an opportunity to lodge in the bend thereof, and it also occasions the point or shoal of sand over against it to advance much further into the channel from the fort side, than it would do, if that elbows wharfing had been made in a less crooked direction: and therefore I sincerely advise, whenever this wharfing is greatly decayed, or even before, if the necessary sums be not wanting, not to repair it in the same position, but to erect a new one, so that the front of it be according to the position marked in No. 1. of the draught edged with blue silk, by a line of red dots, and to fasten the land ties thereof, in the old wharfing; such a new position will considerably increase the force of the land and back waters, and the shoal off the point would soon be greatly lessened, and perhaps be entirely carried away to the great benefit of the navigation.

27. BEFORE I proceed to mention my opinion as to what ought to be done with the old and new north pier, I must propose a new work of the utmost consequence (in my opinion) to the security and improvement of the haven; in order to which, I must put you in mind, Gentlemen, that one of the consequences of shoals and barrs, choaking all former havens, was as it appears from your records; that the land waters, especially in extraordinary land floods, have escaped to the southward, either at the lowest elbow of the haven, or just above it, over the flats, that lie between the elbow and the high lands of the coast. Now what has happened already, may certainly happen again, for from what I observed on the spot, the ground between the *Brush* wharf, and the neighbouring high lands is still much too low to hinder very considerable land floods from escaping; therefore I earnestly recommend as a very necessary work, to secure the haven as soon as possible against the possibility of such accidents; there are in my opinion but two methods or ways to do this effectually; the one I shall now mention here, and shall reserve the other to another place of this report, wherein I apprehend it will come in more properly.—The first method is to join the north extremity of the brush wharfing with the main high land of the Suffolk coast, as I have exprest in
No,

No. 1. &c. by a double row of either whole piles, or at least split piles driven in close together, several feet below the level of low water mark, and in such manner as to *break joint*, then to the southward of these piles, and close to them, to raise a substantial wall or bank of the best clay, mould, or loomy earth that can be procured, to the height of about three feet above the highest line of the rise of extraordinary floods, observing if such good materials being scarce, you should be forced to use worse, to make the slope next to the piles very gentle as is marked in the section No. 3. in which case the whole ought to be cased or coated on the top and sides with mould or good earth, a foot at least in thickness, which in time will acquire a coat of grass and turf, that will greatly preserve the said bank, but if your materials for the said bank are as good as those I first mentioned, the slope next to the piles, need not be made much gentler than that on the south or inside, these two slopes and all the parts are expressed at large in a section thereof at No. 3. of the annexed draught edged with blue silk.

28. In my humble opinion the old north North
 pier was contrived and built very judiciously at Pier.
 first, for as it is chiefly the south pier, that
 forms and preserves Yarmouth haven, by
 directing the ebbing waters right out to sea,
 the

the old north pier therefore being built chiefly for the convenience of heaving in of ships, was made to extend at first, nearly as far out as the old south pier, but was originally built *open* in order to give as much free passage as possible for the escape of the sands which are driven along the coast by the winds and tides ; and it appears plainly from your records, that soon after the old north pier was filled up with split piles and brush wood, the sands did immediately lodge, not only on the north side, but in time at the east end, and even on the south side thereof, in the channel between the piers, which is at present above half way over fill'd with the said sands.

I am sensible that the pretence alledged among others for the filling up the old north pier, viz. that the foundation of the fort walls were in danger of being damaged or undermined by the sea, was a very plausible one, but supposing it was true, that the fort ever was, or ever should be in danger from the sea, by any works made for the preservation or improvement of *Yarmouth Haven* ; the government under whose care this, and all other forts are ; has proper officers and servants, whose business it then would be to secure it by chains and fenders of dove-tail and other piles, properly driven round the said fort, at no very great expence, and supposing that
this

this was neglected, or even supposing that the fort should be rendered useless, or entirely washed away, the loss of it would not be very great, and infinitely less as to value and importance to the nation than *Yarmouth Haven*, for it might easily be supplied by a better, or at least by a battery of the same number of guns.

To return to the old north pier, all I could see of it, was in a ruinous condition, and almost buried in the sands. Therefore my opinion is that there is no occasion to meddle with it, at present, but in case the methods I shall propose for the preservation and improvement of your haven should have the desired effects, and among others, should clear the channel between the two piers, from the sands now lodged there, then in my humble opinion the main land round the fort, on the western and southern sides thereof, must be secured with some such a wharfing as the *Brush Wharf* on the opposite shore, or at least with a row or two of split piles, with a *Capcill*, and a sufficient number of *Land Ties* properly fastened into the solid ground, which wharfing ought to be placed in a direction nearly parallel to that of the *Brush*, and the old south pier, as I have represented by a row of black dots in No. 1. of the draught annexed, edged with blue silk: this wharfing ought to be

be carried no further than the easternmost part of the fort walls, or but a little further to the east; and the care of securing the remainder of the solid land round the fort on the north and east sides thereof may be left to the care of the government.

MOREOVER, if, as I said before, the sands should ever be washed away to sea, from between the piers, by the action of the land and back waters, the remainder of the old north pier ought then to be dug out, or at least sawn as low as low water mark, and a slight kind of open pier, like your town jetty, should then be built from the place where the wharfing just now mentioned ends, to the west end of the new north pier, in order to preserve at all times, a safe communication with the capstanes and crabs erected on the said new north pier, for the heaving in of ships over the barr.

29. As to the new north pier itself, I am of opinion that whenever it was thought proper to lengthen the old south pier further into the sea, it was also equally proper to lengthen the old north pier; not only for the easier heaving in of the ships over the barr, but because whenever it is necessary to have two piers, whether they be filled up or open, at the mouth of any haven, such as *Yarmouth Haven*, where the tides sett nearly along shore;

shore; both those piers should be equally advanced, or so as to have their heads nearly in the line of the setting of the tides, and therefore all I have to advance as to the new north pier is, to preserve it fit for the use it is now applied to, and to repair it were wanting, but to keep it as well as the old north pier, as open as possible, and there is no need of following any other method of construction for that purpose, than that of the town jetty.

I MUST also mention in this place, that I observed the remains of another jetty about five or six hundred yards to the northward of the north pier; and was informed, that some years ago, there was another of the same sort, at the same distance, or thereabouts, to the southward of the south pier, but since taken up. As these jetties, and all such works are great impediments to the free course of tides, and occasion the lodging of the sands, I earnestly advise to take up the remains of this north jetty as soon as possible.

30. UNDER the particular name of the haven, I understand the far greatest part of it, contained between the north extremity of the *Brush* wharf or the *Fort*, and the south end of *Yarmouth Town*; what is lower I call the haven's mouth, and what is higher up to the *Braidon*, I call the *Pool* or *Basin*. To preserve

Jetties,

Jetties
in the
Haven.

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serve

serve and improve this beautiful receptacle and shelter for ships, I advise in the first place, to suffer no new jetties to be built, and to suffer none of those already in being, to extend beyond low water mark, and that if any of them be filled up with brush wood, or other rubbish, let them be entirely cleared, and kept as open as possible, for if such nuisances are suffered, under pretence that they are unavoidable, care ought to be taken to reduce them, and to prevent, as much as possible, the ill consequences that do certainly attend them, which are, that the rivers or harbours do silt up, or what is the same thing, that the depth of water grows less; that the mud and filth encreases on both sides, and consequently the breadth of the channel, and of the navigable waters, is thereby lessened; besides these jetties and causeways, I find an old complaint to have been, a shoal apt to gather near the *Ballow* or *Bollard Point*. 'Tis certain, that nothing is more common to all harbours or rivers, than to have shoals of silt and sand in some particular places, especially off the points which part the different *Reaches*; and the only remedies are, to restrain the stream, or to alter its course, or lastly, to take up so much of it as is necessary for the navigation. As to the first remedy, I shall have occasion to speak of it in another part of this Report; and

and as to the taking the silt up, there is a good engine in your possession, ready built for the purpose, and if that engine be not made use of to the best advantage, it must be the fault of those who make the agreements with the undertakers, for the working of the engine, and carrying the silt away, or of those who are paid to look after the men who perform the said work. As soon as means are found to set it to work, I advise the management and the working of it to be put under proper checks and regulations, which being done, this useful engine should be at work in all places where it may be found wanting, of which I will set down only four places for your information, that is, the shoal or point of sands between the fort and the *Brush Wharf*, the shoals about the *Bollard Point*, the feet of the wharfing of *Yarmouth Key*, and the opposite side, and lastly, the channel for the navigation of the keels, and other vessels up the *Braidon* right off *Red Coat Point*, and thereabouts.

I MENTIONED in the 11th paragraph, the inconveniency attending the laying small sand (for the ballasting of ships) close to the edge of the haven, upon what is called the *Ballast Key*, at the south end of the town of *Yarmouth*; and think it my duty to advise, that this work should, if possible, be done on the

west side of the haven, which is more sheltered from the westerly winds, and from whence the easterly winds could not blow off any part of that small sand and other silt into the haven. I am sensible this might perhaps be attended with some small inconveniences, especially at first, and with some increase of expence in the ballasting of ships; but public good should take place of private interest, and all other considerations, though I know it very seldom does.

31. WHAT I have further to offer for the preservation and improvement of that part of the haven which lies before *Yarmouth Town*, and which, for distinction sake, I have called the *Basin* or *Pool*, may be comprized under these three articles; the repairs of the wharfs of the keys and the opposite side, the repairs of *Yarmouth Bridge*, and the removal of all encroachments above or below it. As to the first, the corporation of *Yarmouth* knows whose property those wharfs are, and consequently who is by law obliged, or who may be obliged (if proper steps be taken) to repair them, in a proper and substantial manner.

As to their construction, I have no fault to find with that already made use of, but I earnestly advise, that the proper officers be enjoined to take care that the repairs be done
in

in a strong and workman-like manner; and that instead of all the bites, bends, nooks, angles, and corners, in which the present wharfs extend, care be taken in the repairs, to join them together without any sharps, angles, or returns, but so as to form a gentle sweep all the way, with as few turns in or out as possible, and as near to a streight line as the nature of the place will admit of.

MOREOVER, I am of opinion, that those wharfs which are most in shore, and want a thorough repair, or to be intirely new built, ought to be extended as far into the water, (but no farther) as those that are now the most out below the bridge; and what I mentioned for *Yarmouth side*, ought likewise to be observed, in the repairs of the wharfs on the other side.

As to *Yarmouth Bridge*, if an intire new one should be thought too expensive at present, all its upper works ought at least to be made new; I am sure that an able carpenter can easily place or graft them on the old piles, without the trouble and expence of pulling them up, and driving new ones in their stead.

AND as to the last article, viz. the removal of pernicious encroachments, either above or below the said bridge, if any buildings, docks, or advanced wharfs, should be found by a proper and impartial jury, or inquest, deserving to be presented as such, I hope, for the sake of all those who are concerned in the preservation of *Yarmouth Haven*, that either by entreaty or by law, they shall be removed.

32. I PASS ON to what may relate to the preservation of the *Braidon*, and the navigation through it. As to the *Braidon* having silted of late years, if it be true, I do not think that it is in the power of any set of men, to restore it to its former depth all over, or to give it a greater by any natural method, or by any artifice, without an immense expence, and therefore I advise all persons concerned to rest easy on that head, and the rather so, because I have mentioned already in the first part, that all rivers and lakes do silt up, and deepen alternately after every course of dry and wet years—Moreover provided that the channel up the *Braidon* into each of the three rivers, be kept free and open for the navigation; the depth of the *Braidon* every where else is not very material to the haven, for all the water in the *Braidon*, that is of any use for scouring the haven, is only that part of it, which having been brought
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up by the preceding flood, is left there two hours before the end of the succeeding ebb, and for this reason, I must observe, that if according to my advice, the engine be made use of, to deepen that part of the channel up the *Braidon*, right off *Red Coat Point*, and thereabouts, where it is rather too shallow for loaded keels, the silt taken up may very easily be disposed of, without carrying it to a further distance than the next shore on either side, taking care, however, for the reason given above, that what is thrown out, be not thrown out so near the shore, or in such heaps, as that any part of it does appear at low water, for whatever is under low water mark, is of no detriment to the haven, nor any diminution of the back waters.

33. As to the three rivers, the *Bure*, the *Yare*, and the *Waveney*, I have already mentioned that I found them in very good order, excepting their being too much incumbered with rushes and weeds, so that nothing appears to me wanting there, than to clear them from the said rushes and weeds, which (in my humble opinion) ought to be done at least twice a year, observing that one of the clearings be always performed a little while before the feeds are ripe, or ready to be shedded; and as the cutting of rushes and weeds is an

operation easily performed, and which costs but little, I shall add nothing further.

GENTLEMEN, I have now gone through all the works and repairs which appears to me the most, and soonest necessary to be done, for the preservation and improvement of *Yarmouth Haven*, from the mouth thereof to the town of *Yarmouth*, and from thence up into the *Braidon*, and the three rivers; but I have another considerable work to propose, which bids the fairest for clearing the haven's mouth in time to come, from all shoals and bars, or at least keeping some passages through it always open, and this by employing only such natural means as are in your power, without entering into any dubious (as to success) or expensive works.

Wharf
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ven.

THE proposition is this, to reduce the haven into a reasonable breadth, by wharfing it on each side, from the south end of *Yarmouth Town* to the west end of the remains of the old north pier, and from that part of the *Sussex* shore, which is opposite to the south end of *Yarmouth*, to the north extremity of the *Brush*.

The best position for the fronts of these wharfs are at present (in my humble opinion) the very lines of low water mark, all the way
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on both sides, by taking in no more, the breadth of the haven would still be very commodious, and no difficulty would occur in the execution of the said wharfs, which would be sufficiently strong, if performed either in the same manner as the *Brush Wharfing* or as the wharfings at *Yarmouth Town Key*.

The first advantage resulting from such wharfing is, that by making as many slips or docks and stairs in the said wharfs, as shall be thought necessary, there would be in the first place no occasion for any jetties or causeways, which I have mentioned to be great nuisances, and which might then be entirely taken away, but the greatest advantage that would certainly result from reducing the haven to the lines of the present low water mark, and for which end chiefly I do propose it, is, that the duration and velocity of the back waters would thereby be greatly increased, and consequently the shoals in the haven, and perhaps the whole bar, or at least the greatest part of it, would be soon carried into the sea.

MOREOVER the haven would acquire a good depth of water all the way, and consequently deepen where it wants it most, which is between the towns end, and the fort,

fort, the haven's spreading itself between those two places, into several bites of no use to navigation, and whoever will consider the good stream which the back waters have at *Yarmouth Bridge*, and indeed all the way lower to the south end of *Yarmouth Town*, before the haven begins to widen, must be convinced of the truth of what is asserted; I only know of two objections to this proposition, viz.

SOME persons may imagine that the haven being made narrower, the tides would not flow so freely up into the haven, and consequently that the tides of flood would not rise so high as they do now in the *Braidon*, and the three rivers, nor run so far up into the country, so that instead of an increase of back water as is proposed; they may fear that there would be even less than at present, but those who may think so, do not consider that there is no intention by this last proposal, to reduce the breadth of the entrance of the haven between the piers, through which the tides of flood that goes up must enter, and will enter as before, nor to lessen the haven at the bridge, thro' which all that goes up into the *Braidon* and the three rivers must pass, and will pass then as it does now, and that the reducing the haven, between the town and the fort,

fort, to the lines of it's low water marks, will still leave it wider all the way, than it is at the enterance between the piers, or at the bridge, and therefore the tides will no ways be affected by this reduction; and indeed were it not on account of the great expence of a close piling, and other expensive works, I would have proposed the reducing the breadth of the haven, between the town and the fort, not only to the lines of low water marks, but so much more, as to reduce it all the way to a regular breadth, no where exceeding the breadth of the river at the south end of the town; but this may be left to some succeeding generations.

THE other objection likely to be made is, that the haven is good enough at present, and that the expence of reducing it as proposed, would amount to very large sums; as to the first part of this objection, I am not of opinion that the haven is good enough, or as good as it might be, but that it might, and ought to be made deeper and its entrance cleared, which is the chief intent of the proposition, and as to the expence, I have reasons to think it will not be so considerable, as to deter the persons concerned from the execution thereof. Moreover the fund for these and all other works and amendments, being a duty or tunnage on
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various kinds of goods, it is certainly the most fair means that can be thought of to obtain such great benefits as those of improving of *Yarmouth Haven*, and keeping its entrance clear; sure I am that all the advantages that would then acruë to the city of *Norwich*, town of *Yarmouth*, and all the adjacent countries, would very soon over ballance the tax of a few Years.

As to a general estimate or particular estimates of all works and repairs which I have proposed, it is hardly possible to be very exact in such a variety of articles, but since I am of opinion that the methods of construction already made use of for the piers, jetties, and wharfings, will be sufficient if performed carefully; precedents cannot be wanting to judge of the reasonableness of all future proposals for those kinds of works and repairs, and as to the filling of the new south pier with stone mortar, since no such work, that I know of, has lately been done in England; it cannot be estimated to a nicety, but I can safely affirm that it will be the cheapest of all those which will fully answer the purpose intended. I think it therefore sufficient to mention in general, that from the several computations I made, and so far as I am able to judge, the whole neat amount of the
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expence of all the said works and repairs, exclusive of all such incidental charges as are unavoidable in the execution of all such publick undertakings, will not exceed 22,000*l*. and will not require above four or five years at most to compleat them.

BUT before I conclude, give me leave Gentlemen to add a few words of advice as to the execution of whatever works shall be thought necessary to be done hereafter.

SINCE it is impossible to avoid having some parts of the works performed any other way than by day's work, wherein the greatest impositions and frauds are, or may be committed. I humbly advise to do as little work as possible by day's work; and what shall be found impracticable to be done any other way, or such that no body will offer to do it by contract at a reasonable price, let it be committed under the care of an able and honest Surveyor or Overseer, who (as well as a Comptroller or Clerk of the Check, if there should be occasion for one) should be chosen by merit, and not by favour; should have authority and latitude enough to make all the people under them do their duty, and obey directions, by having it in their power

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to turn away the common men, and at least to suspend the masters till further orders, in case of their misbehaving; and as those persons should have sufficient allowances, so should they themselves be dismissed and severely punished, if they were found to encourage, or connive at, any fraud.

ON the other hand, I recommend, that in all works which I have proposed, as much as can be done, ought to be done by contract; in which the prices and times of performance be limited, with a saving clause in each, that any alteration or variation in the designs or execution, from what was at first contracted for, shall not vacate the contracts, &c. Yet I cannot recommend the method of receiving sealed proposals for the works, and taking the lowest of all the proposers, who can find security, preferable to all other considerations, such as superior knowledge, great practice, and a good character; because I know that the proposers endeavour to beat one another down in their prices, and to get into the works, offer to perform them at so low rates, that they must either lose by it, or save themselves upon the quantities or qualities, or both, of the materials delivered, and work done.

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As to the order of time in which the several new works and repairs, mentioned in this report, ought to be done, I would advise to follow the very same order in which they are set down, that is to say, the first care should be to repair the new south pier, and to make it tight, and the last work should be the new wharfings proposed all the way on both sides of the haven. If these wharfings be resolved upon, the new bank or wall of earth, which I advised to be erected between the *Brush* and the high lands of the *Suffolk Coast*, will be saved, but if the wharfings are not approved of, or be postponed for many years, the said bank should either be built the first of all, or at least be taken in hand, together with, or soon after the repairs, and the filling up of the new south pier.

GENTLEMEN, I have now gone thro' the last part of my report, in as few words as the nature of the subject would admit of, and I could not be less explicit in practical matter of so great concern. I have on every head, and thro' the whole of this report, given you my opinion, fully, fairly and honestly, with the chief reasons I had for being of that opinion; I hope therefore that for the sake of my good intentions, you will excuse the freedom of my expressions, and moreover will
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do me the honour of ranking me among those
who are, as I am most sincerely, and with
all due respect,

Gentlemen,

Your most obedient,

and most humble servant,

CROWN-COURT, CHARLES LABELYE,

King-street, Westminster,

Jan. 18th, 1747.

*To the Right Worshipful
the Mayor, &c. of Yarmouth,
in Norfolk.*

N. B. The Map referred to in the foregoing observations, is not at present to be found; if any Gentleman who has formerly been in the Pier Act Commission, has it in his possession, he will oblige the public by sending it to Mr. *Spurgeon* of Yarmouth, who will cause it to be engraved, and a sufficient number of copies printed, to annex to this publication.

F I N I S.